PCT/AU2004/001040

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I, LEANNE MYNOTT, MANAGER EXAMINATION SUPPORT AND SALES hereby certify that annexed is a true copy of the Provisional specification in connection with Application No. 2003904353 for a patent by JOHN HOLLY as filed on 05 August 2003.

WITNESS my hand this
Sixteenth day of August 2004

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P/00/009 25.5.91
Regulation 3.2

AUSTRALIA

Patents Act 1990

PROVISIONAL SPECIFICATION

Invention Title:

SEED DISTRIBUTION METHOD AND APPARATUS

The invention is described in the following statement:

SEED DISTRIBUTION METHOD AND APPARATUS

This invention relates to a method of seed distribution and an apparatus for achieving this. However the invention is also related to distribution of other particulate matter in the field of farming including fertilisers, fungicides, insecticides, herbicides and mixtures.

Throughout this document reference to the word "seeds" therefore includes seeds and other particulate matter in the field of farming including fertilisers, fungicides, insecticides, herbicides and mixtures.

It is known but not commonly known to use vacuum systems to pick up seeds and to break the vacuum to release the seed for planting. Disc and drum vacuum planters creating separate areas of pressure difference enables the selection of individual seeds for precise seed placement. One such drum system is shown in US Patent No. 4,306,509 which discloses a planting apparatus characterized by the ability to continuously meter seeds onto a seedbed and simultaneously press the seeds into the soil, and so as to facilitate separate single seedlings by the placement of the seeds on the seedbed in a predetermined, uniformly spaced array. The apparatus comprises a frame, drum means, a plurality of manifolds mounted within the drum means, hopper means, vacuum means, and cleaning means. The drum means has a cylindrical peripheral wall and a plurality of apertures aligned in circumferential and longitudinal rows and uniformly spaced circumferentially and longitudinally over substantially the full area of the peripheral wall for selecting and pressing seeds, the drum means being rotatably mounted to the frame so as to be adapted to be moved in rolling contact across the seedbed, and the drum means bearing the weight of the frame and being pressed thereby into the soil. The plurality of manifolds is mounted within the drum means, with each manifold operatively communicating with at least one of the longitudinal rows of apertures. The hopper means is fixedly mounted to the frame and has an open delivery end for supporting seed on a portion of the exterior side of the peripheral wall of the drum. The vacuum means is for reducing the atmospheric pressure within the interior of the manifolds during only that

portion of the movement of the associated rows of apertures through the hopper means and to the seedbed. The vacuum means comprises vacuum source means mounted on the frame, a plurality of flexible hoses mounted for rotation with the drum and with each hose being operatively connected to respective ones of the manifolds, means for operatively interconnecting the vacuum source means with each of the hoses and thus each of the manifolds, and cam means mounted on the frame for successively collapsing each of the hoses during a portion of each rotation of the drum to thereby interrupt the reduction of pressure within the associated manifold. The cleaning means mounted on the frame for continuously removing any soil and other matter from the exterior side of the peripheral wall as the drum means rotates. As the drum means is rolled along the seedbed, the drum means is cleaned, the seeds in the hopper means are held against the apertures by the reduced pressure and are carried on the peripheral wall of the drum means from the hopper means to the seedbed, and the seeds are released and pressed into the soil by the weight of the apparatus upon reaching the seedbed.

A major problem with such systems is that while they fulfil their respective requirements they operate at relatively slow speeds, which thereby restricts the machines planting speed. All of the prior art apparatuses pick up individual seeds from a stationary pick-up area on one side of the rotation of the drum and drops them off on the other side. This can only be achieved at relatively low rotation speeds. At higher speeds the surface of the drum passes the seed too quickly which results in failure to pick up the seed. The majority of these machines are limited to sowing ground speeds of 12 to 15 kilometres per hour.

It is an object of the invention to provide a method of seed distribution and a seeding apparatus, which overcomes or at least ameliorates the problems of the prior art.

In accordance with the invention there is provided a method of seed distribution and a seeding apparatus for achieving this, which includes a feed system providing an acceleration of seed that provides substantially stationary relative velocity or less velocity between the feed system and a moving metering system of a seeding apparatus. The

method of seed distribution and the seeding apparatus can have a feed system which provides an acceleration of seed that provides substantially stationary relative position.

The invention also provides a seeding apparatus for providing single seed placement in a continuously moving apparatus in a predetermined, uniformly spaced array, and the seeding apparatus including a frame integral with or attachable to a vehicle; a drum means mounted on the frame and having a cylindrical peripheral wall with a predetermined arrangement of a plurality of apertures; drum rotation means for rotatably mounting said drum means on said frame with the axis of said drum means extending substantially horizontally; a vacuum generating means connected with said drum means and operatively communicating with said apertures to provide a vacuum suction through the apertures; receival hopper means mounted on the frame for receiving seed and communicating with a feeding system mounted alongside the drum and having an acceleration means for feeding seed from the receival hopper to the external surface of the drum means at a speed; and a release mechanism for countering the hold of the vacuum suction on the seeds; whereby as the drum rotates the seeds from the hopper means are held against the apertures by the reduced pressure and are carried on the peripheral wall of said drum means from said hopper means to the release mechanism whereat the seeds are released into the seedbed.

The acceleration means for feeding seed from the receival hopper to the external surface of the drum means can be at a speed substantially equal to or less than the speed of rotation of the drum means. It can be seen that providing seeds at speed substantially greater than speed of the drum will knock off the attaching seeds. Preferably the speed is substantially the same as the surface speed of the drum.

The acceleration means of the feeding system can be one or more belts frictionally engaging the seed with the belt speed controlled relative to the drum means rotation speed. In another form the acceleration means can be an air jet for blowing seed out along a close circumferential or tangential path at a speed substantially equal to the drum means rotation speed.

The feeding system can be mounted on the same diametrical side as the release mechanism.

The release mechanism can be a mechanical deflection system which in one form is a frictional brush system externally of the drum means or can be a vacuum cut-off means operating internally of the drum means such as a roller. The drum can have on its surface or be constructed of material which enhances its ability to accelerate and capture seeds thereon.

The release mechanism can provide a release beyond the vertical tangent of the drum means to ensure at least a partial deflection of the released seed away from a vertical fall to form a metered seed release trajectory. The material which is not metered by vacuum contact with the drum means can fall vertically into a second unselected particle trajectory. This trajectory can lead to a recycle means in which the unselected particles are returned to an input of the system such as the receival hopper.

The metered seed sent on the metered seed release trajectory can be further controlled by a venturi system to control an exit speed and number of seeds. The exit speed can be controlled such that the exit speed is substantially opposing the speed of the vehicle on which the seeding apparatus is loaded to provide a relatively stationary deposit of the seeds.

The present invention enables a rotating perforated drum containing an internal vacuum or area of considerably lower pressure than the atmospheric pressure on the outside to attach seeds onto the apertures on its outer surface at high rotational speeds. This is achieved by accelerating the seeds and presenting them at a particular section of the drum travelling at or near the same speed and travel direction as the apertures on the outside surface of the drum, resulting in considerably increased sowing machine ground speeds.

It can be seen that the invention overcomes the restrictions of the prior art by applying the principle that when two or more objects are travelling next to each other in the same direction and at the same speed they will appear stationary relative to each other irrespective of their speed relative to a separate stationary object. Therefore it follows that accelerating the seeds so that at a given point in the rotation of the drum surface they travel in close proximity to and in substantially the same direction and speed as the apertures on a drum surface the seeds will be picked up as if both seed and aperture are stationary relative to each other. As absolute vacuum is the maximum theoretical adhesion pressure available a situation will eventually be reached where the force from the rotation of the drum will be greater than the force holding the seed onto the surface. However using the inventive method described rotational speeds far greater than those used on present seeding machines will be attained.

In order that the invention can be more readily understood embodiments of the invention will be described by way of illustration only with reference to the drawings wherein:

Diagram A is a schematic block diagram showing separate functions on machine;

Figure 1 is a schematic drawing of a partial cross section of a single belt and drum of a seeding apparatus in accordance with a first embodiment of the invention;

Figure 2 is a schematic drawing of a partial cross section of a double belt and drum of a seeding apparatus in accordance with a second embodiment of the invention;

Figure 3 is a schematic drawing of a partial front view of a drum that can be used in a seeding apparatus in accordance with the first or second embodiment of the invention shown in Figures 1 and 2;

Figure 4 is a schematic drawing of a partial side cross sectional view of the drum and exit structure of a seeding apparatus that can be used in accordance with the first or second embodiment of the invention;

Figure 5 is a schematic drawing of a cross sectional view of a seeding apparatus in accordance with the second embodiment of the invention showing the metering mechanisms;

Figure 6 is a schematic drawing of a partial cross section of a seeding apparatus in accordance with the second embodiment of the invention with a return mechanism of non-seeded material.

Appendix A is an initial document of the invention

Referring to Diagram A there is shown a seeding apparatus that includes a main particle storage bin that feeds material to be distributed to a particle receival hopper, agitator, separator, sorter and accelerator. This will be further described in Section A. The material is fed to an individual particle selection and trajectory separation. This will be further described in Section B. The separated material is attempted to be picked up by the particle conveying including ejection velocity control. This will be further described in Section C. However the excess that is not picked up is collected by the excess particle recycle system and returned to the ain particle storage bin. This will be further described in Section F. The material picked up has exit velocity monitored and controlled to be seeded at required spacing. This will be further described in Section D. The control is undertaken by electronic function monitoring control as will be further described in Section E.

Referring to Figures 1 to 6 of the drawings the features, as detailed by the numbers, are as follows:

1. Drum containing perforations and vacuum on inside;
2. area of low pressure – vacuum within drum;
3. hollow area in drum support axle by which vacuum is applied to drum;
4. hollow axle;
5. drum bearing and seal allowing drum rotation around stationary axle;
6. spring applying tension on vacuum cut-off roller to keep it on drum;
7. vacuum cut-off roller used to eject selected seeds off drum outer surface and also to set height of blockage clearing air jet. As the roller is in contact with the inner surface of the drum it is driven by the rotation of the drum;
8. blockage clearance positive pressure air jet which can also be used to eject seeds as does 7. Where 8 meets the inner surface of the drum it has a seal designed to minimise the escape of the positive air pressure into 2 which is the vacuum area;

9. flat belt which is kept on the outer surface of the drum by the suction pressure applied through the perforations and is therefore driven by the drum's rotation. This belt is used to block the drum perforations on a large part of the circumference thereby reducing the size and volume of he vacuum generating mechanism required;
10. idler rollers supporting and guiding continuous flat belt 9;
11. tension roller used to keep tension on belt 9;
12. accelerator belt used to accelerate seeds;
13. accelerator belt drive pulley = can be independently driven or driven mechanically off drum 1;
14. agitator – rotating, vibrating or both used to prevent blockages and ensure smooth flow of seeds;
15. receival hopper;
16. unseparated seeds recycle mechanism;
17. unseparated seeds in main stream – trajectory 1;
18. metered / separated seeds evenly spaced – trajectory 2;
19. venturi for conveying seeds to exit point and controlling seed exit velocity. One venturi per row on the drum;
20. tube or vein by which seeds are conveyed from 19 to exit points, these can be rigidly or flexible allowing for row spacings to be adjustable;
21. seed exit velocity monitor;
22. evenly spaced seeds leaving rear of machine;
23. trajectories 1 and 2 separation area;
24. corridor carrying metered seeds to section C;
25. hose/vein suppling positive air jet pressure to 8;
26. corridor carrying unseparated main seed stream to section F;
27. butterfly shut off valve used to stop seed flow;
28. wedge used as block unused perforations on drum, which has same function as 9;
29. hinge allowing support 30 to swing away;
30. support for 7 and 8 which are joined in such a way that the roller 7 sets the height of 8 and both act as seed ejection devices with 8 also clearing blocked perforations. The assembly I hinged 29 so that it can swing away from the drum inner surface if necessary and is held in place by the pulling pressure exerted by the spring 6.

The use of 9 and 28 assist in concentrating and maximising the suction effect produced by the vacuum inside the drum onto the seed separation section and also results in not having to use as large a fan or vacuum pump for a given drum size.

Section A: Particle storage, sorter, separator and accelerator

As shown in Figures 1 and 2 a receival hopper is located above the drum means and receives the seeds from a main storage bin (not shown). This is achieved by gravity if placed below the storage bin, or the seed can be transferred by pneumatic or mechanical means if placed above the storage bin.

The receival hopper narrows towards the bottom and at the bottom of the receival hopper there is an agitator, which prevents blockages thus ensuring a smooth flow of seeds. The agitation can be a vibrating apparatus or as shown a rotating mechanism or combination of these. The agitator provides an even uninterrupted supply of seeds to a feeding system having an accelerator in the format required. The accelerator can be mechanical pneumatic or any other means to give the desired outcome. One method is to move the seeds using a single belt as shown in Figure 1 or alternatively as shown in Figure 2 between two moving belts so that the seeds are held between and by the belts and thereby accelerated up to the same speed as the belts which are controlled to travel at the required speed. The gap between the belts and the belt speed are adjustable. The belts can be flat, contoured or shaped in a way to provide the desired outcome.

The function of the accelerator is to accelerate the seed so that when presented at the drum surface as will be described in Section B the seeds will be travelling in the same direction and at the same speed as the drum surface where both make contact. Ideally the seeds should travel at slightly slower than the drum surface thus compensating for misalignment of aperture and seed. If the seeds are travelling faster than the drum apertures they might have a tendency to brush attached seeds off as they travel past.

The hopper, agitator and accelerator ideally have the dimensions so that seeds will be presented to the drum surface evenly but adjustably and across the required drum width. Typically the width of the feeding system shall be similar to that of the drum means.

Section B: Particle Selection, Separation and Trajectory Separation

Seeds that have been accelerated are presented from the accelerator belt to a rotating drum's outer perimeter as shown in Figure 3 the drum perimeter has rows of evenly spaced holes through the surface.

The drum contains within it a vacuum that is created by an external vacuum generating mechanism connected through axial tube to the drum means. This creates an area of considerably lower pressure within the drum than the external atmospheric pressure. The pressure difference causes the seeds to be held onto the holes on the perimeter of the outer surface of the drum. The holes therefore must be smaller than the seeds to prevent the seeds travelling onto the drum itself. By blocking the holes the seeds help to maintain a negative pressure inside the drum as material or air is prevented from entering the drum to break the vacuum or decrease the pressure differential between internal and external pressure.

The drum in one useful embodiment has a circumference of 1 metre with about 100 holes 10 millimetres apart on each line of the drum perimeter. With the drum rotating at about 165 revolutions per minute a seed is planted every 5 centimetres within a row when the vehicle is travelling at 50 kilometres per hour. The diameter of the drum can be varied to give the required outcome.

The seeds, which are held onto the outer surface, are separated from the air stream of unattached seeds by the rotational movement of the drum. The unattached seeds continue in the direction initialised by the accelerator in the feeding system while the attached seeds which have been separated from the main stream have travelled around to a position where they are released off the drum's surface. The release of these seeds can be done in a variety of ways including deflection mechanisms on the outer side or by temporarily cutting off the vacuum supply on the inner side of the drum. On separation these seeds will continue to travel off along the tangent at the point of release, which will be a trajectory different to the main stream of seeds, which are not attached.

In this way the feeding system and drum system of Section B has provided a mechanism for selecting seeds at regular intervals and separating those selected seeds from the main seed stream thereby accurately metering those separated seeds allowing for the counting and accurate spacing of those seeds. The selected separated seeds continue onto the exit system of Section C while the unseparated seeds in the main stream continue onto recycling system of Section F.

As the seed stream, which has been accelerated by feeding system of Section A, is several seed widths thick it presents two surfaces. The drawings provided show one side of this seed stream making contact with one drum surface in Section B. An additional drum placed directly opposite the first and rotating so that it selects seeds from the other side of the stream can be utilised. This means the accelerated seed stream passes between both drums. Furthermore as the unattached seeds in the stream in the stream travel onto the recycle system of Section F additional drums can be added below in a vertical tiered format. The use of multiple drum set-ups can drastically increase a machine's ground speed and also the area covered in one pass.

Section C: Conveying Metered Particles and Controlling Particle Exit Velocity

The function of Section C is to accept the metered seeds from metering drum of Section B and convey them to the exit system. This process can be accomplished in several ways including pneumatic or mechanical means. One method is to have a system involving the guidance of the metered seeds originating from the rows of holes on the drum in Section B into the suction sides of multiple venturis with one venturi corresponding to one drum row of apertures. The venturi system will cause the seeds to travel along tubes or veins to their required exit points. If flexible tubes are used this will allow the distance between exit points to be variable allowing for the easy spacing of seeding row widths on the ground. Each row results from a particular tube which originates from a corresponding venturi which gets seeds from a particular row of holes on the drum in Section B and the spacing of each seed is set by the distance between the holes making up the rows on the drum and the rotational speed of the drum surface in relation to the ground speed of the machine.

By controlling the venturi system one is able to control the exit velocity of the seeds at the end of the tube. The advantage of controlling and by implication being able to vary the exit velocity of the seeds becomes clear at high machine travel speeds. A machine travelling in one direction at a ground speed of 50 kilometres per hour ejecting metered seeds horizontally from a height of 0.5 metres and in the opposite direction at 50 kph will have the same effect as dropping seeds from stationary position at 0.5 metres height resulting in minimal seed bounce and the maintenance of relatively even seed spacing.

Section D: Particle Exit Velocity and Tube Blockage Monitor

The function of Section D is to monitor the velocity of seeds exiting the tubes originating from Section C. This data is transferred to the electronic control of Section E where it can be used to alert the system to a blockage resulting in failure to seed on a particular row as well as enabling the setting of exit velocities to match machine ground speeds.

Section E: Control Unit

The function of Section E is to monitor and control the various operations on the machine including items such as seed exit velocity, machine ground speed, drum surface speed, drum revolutions per minute, seed count, area covered, seed rate per hectare, hopper seed levels, venturi output etc. Electronic control unit is a preferred embodiment but it could be mechanical.

Section F: Main Stream Unmetered Particles Recycle/ Return System

The function of Section F is to collect all the seeds coming from Section B which were not separated off by Section B and return them to the main storage bin or to the receival hopper in Section A. If Sections A and B of the assembly are situated above the main seed storage bin the seeds will be lifted into the receival hopper of Section A from the main storage bin and the seeds from Section F fall back into the main storage bin under gravity. If Sections A and B of the assembly are situated below the main seed storage bin then the receival hopper in Section A can be supplied by gravitational means and the

seeds from Section F can be returned to the main storage bin by pneumatic or mechanical means.

It should be understood that the above description is not limiting of the invention. Clearly other variations, which are understood by a person skilled in the art without any inventive element, are included within the scope of this invention.

for the applicant John Holly
By his patent attorneys
PIPERS Melbourne

5 August 2003

APPENDIX A

VACUUM PARTICULATE MATERIAL METERING SYSTEM FOR A HIGH SPEED SEEDER

DEFINITION:

Particulate material or particles in this document shall include any material type used in seeding operations including seeds,fertilizers, fungicides, insecticides, herbicides and any other that is presented in a particulate form.

NOTE: Where the word seed or seeds is used in this document it also applies to any of the above mentioned particulate materials

ABSTRACT

This invention relates to an assembly for metering particles originating from a storage hopper for even distribution onto the ground at high machine travel speeds.

BACKGROUND OF THE INVENTION

The present invention relates to machines which simultaneously distribute multiple type particulate materials such as seeds and fertilizer onto the ground during seeding operations.

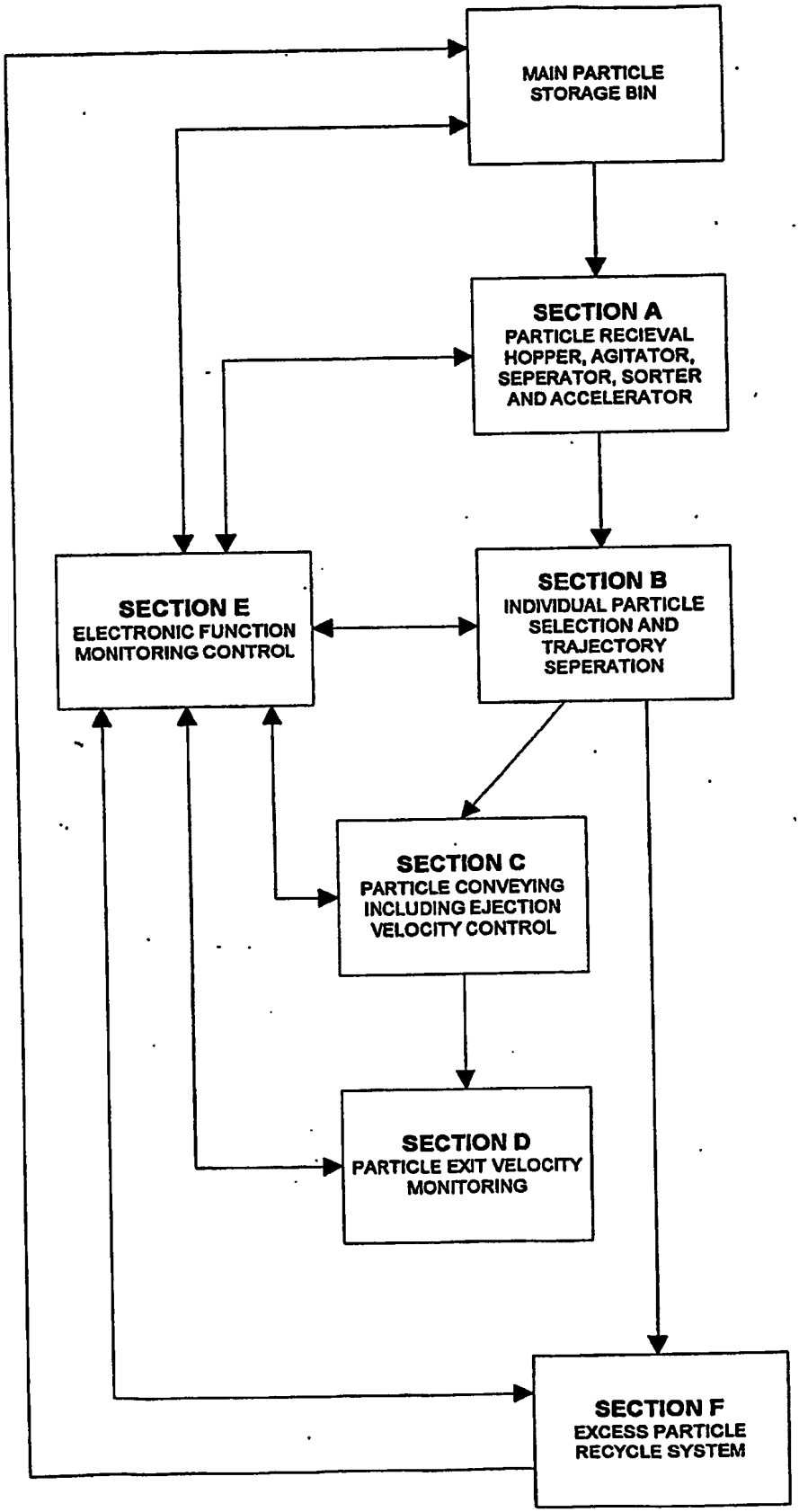
The use of vacuum to meter seeds in planting machines has been well established by numerous prior art. Disc and drum vacuum planters creating seperate areas of pressure difference enabling the selection of individual seeds for precise seed placement are well known.
While these devices fulfill there respective requirements, the relatively slow speeds at which they perform these operations is a restriction to the machines planting speed. A rotating disc or drum which picks up individual seeds from an area on one side of its rotation and drops them off on the other side can only do so at relatively low rotation speeds. At higher rotation speeds the surface of the drum/disc travels past the seed too quickly resulting in an eventual failure to pick up seeds. The majority of these machines are limited to sowing ground speeds of 12-15 kph.
There are many advantages in being able to accurately meter seeds enabling sowing at ground speeds considerably higher than 15 kph.

The present invention overcomes the restrictions mentioned above by applying the following principle. When two or more objects are travelling next to each other in the same direction and at the same speed they will appear stationery relative to each other irrespective of their speed relative to a seperate stationery object. Therefore it follows that accelerating the seeds so that at a given point in the rotation of the drum surface they travel in close proximity to and in the same direction and speed as the apertures on a drum surface the seeds will be picked up as if both seed and aperture were stationery relative to one another. As absolute vacuum is the maximum adhesion pressure available a situation will eventually be reached where the force from the rotation of the drum will be greater than the force holding the seed onto the surface. However using the inventive method described in this invention rotational speeds far greater than those used on present machines will be attained.

SUMMARY OF THE INVENTION

The present invention enables a rotating perforated drum containing an internal vacuum or area of considerably lower pressure than the atmospheric pressure on the outside to attach seeds onto the apertures on its outer surface at high rotational speeds. This is achieved by accelerating the seeds and presenting them at a particular section of the drum travelling at near the same speed and travel direction as the apertures on the outside surface of the drum, thus resulting in considerably increased sowing machine ground speeds.

EMATIC BLOCK DIAGRAM SHOWING SEPERATE FUNCTIONS ON MACHINE



SECTION A

ARTICLE STORAGE,SORTER, SEPERATOR AND ACCELERATOR

OTE: In this document the word **seed** or **seeds** will be understood to mean ny particulte material which can be used.

his section has the following functions.

. It contains a receival hopper to receive the seeds from a storage bin. This can be done by gravity if placed below the storage bin, or the seed can be transfered by pneumatic or mechanical means if placed above the storage bin.

. At the bottom of the receival hopper there is an agitator which has the job of preventing blockages thus ensuring a smooth flow of seeds. This may be a vibrating apparatus or a rotating mechanism or combination of two. The agitator ensures an even uninterupted supply of seeds to the accelerator in the format required.

. The function of the accelerator is to accelerate the seed so that when presented at the drum surface (Section B) the seeds will be travelling in the same direction and at the same speed as the drum surface where both make contact. Ideally the seeds should travel at a speed slightly slower than the drum surface thus compensating for misalignment of aperture and seed. If the seeds are travelling faster than the drum apertures they may have a tendency to brush attached seeds off as they travel past. The accelerator may be mechanical, pneumatic or any other means to give the desired outcome. One method is to move the seeds using a single belt or alternatively between two moving belts so that the seeds are held between and by the belts and thereby accelerated up to the same speed as the belts which are controlled to travel at the required speed. The gap between the belts and the belt speed are adjustable. The belts may be flat,contoured or shaped in a way as to provide the desired outcome.

NOTE:
The hopper, agitator and accelerator ideally shall have the dimensions so that seeds will be presented to the drum surface (Section B) evenly (adjustable) and across the required drum width. Typically the width of Section A shall be similar as that of the drum in Section B.

NOTE:

All drawings and diagrams contained in this document are not drawn to scale and are used as illustrations only. The use of symbols to show certain functions eg agitator in Section A does not depict the actual image of the item.

SECTION A

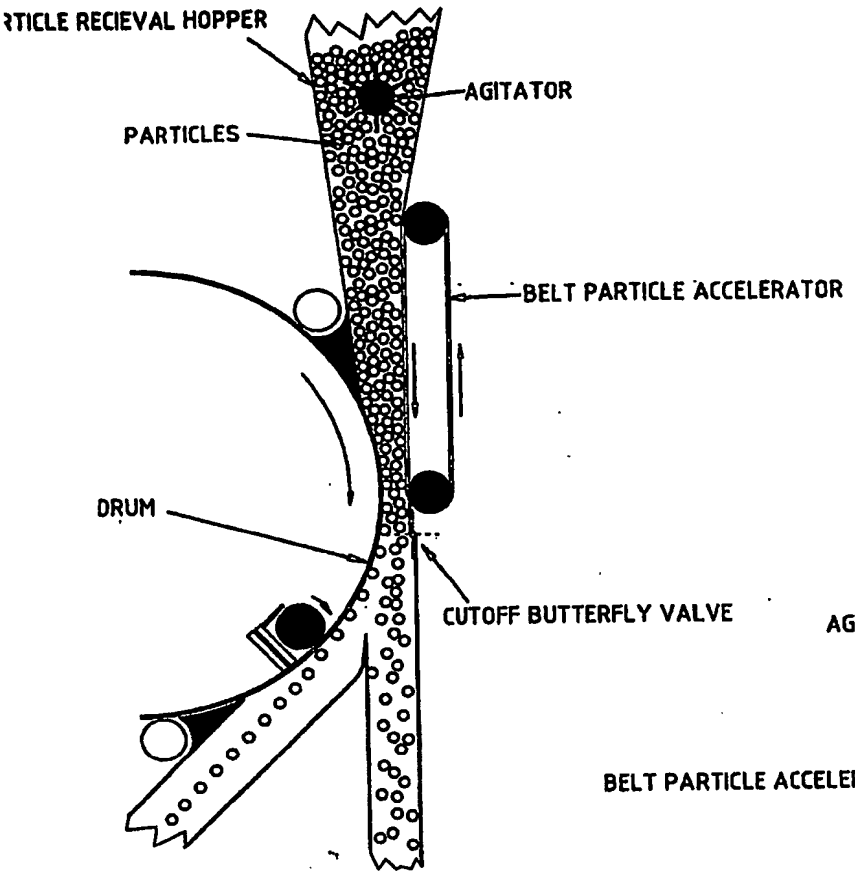


FIGURE 1.

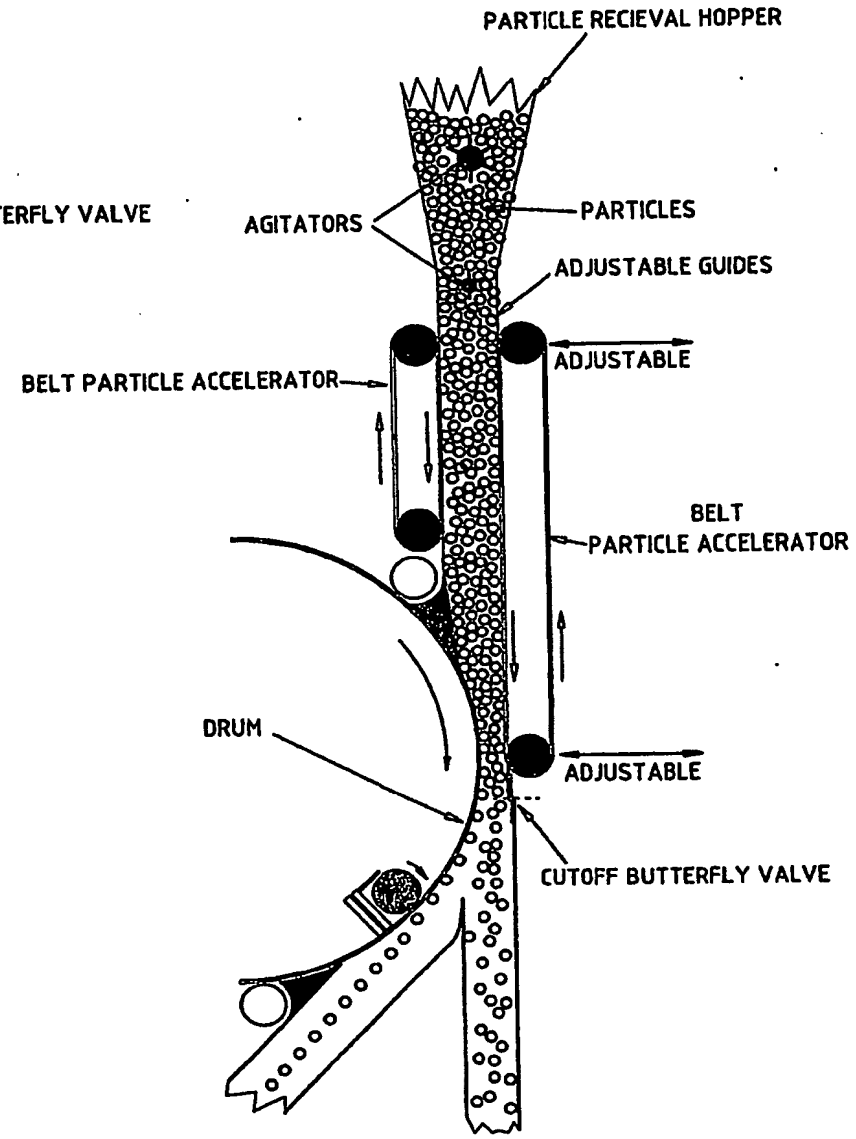


FIGURE 2.

SECTION B

PARTICLE SELECTION, SEPERATION AND TRAJECTORY SEPERATION

NOTE: In this document the word **seed** or **seeds** will be understood to mean any particulte material which can be used.

In this section seeds which have been accelerated are presented from Section A at a rotating drums'outer perimeter which has rows of evenly spaced holes penetrating the surface. The drum contains within it a vacuum or area of considerably lower pressure than the atmospheric pressure on the outside. The pressure difference causes seeds to be held onto the holes penetrating the perimeter and onto the outer suface of the drum. The holes being smaller than the seeds prevent the seeds travelling into the drum itself, and by blocking the holes the seeds help to maintain a negative pressure inside the drum.

The seeds which are held onto the outer surface are seperated from the main stream of unattached seeds by the rotational movement of the drum. The unattached seeds continue in the direction initialised by the accelerator in Section A whilst the attached seeds which have been seperated from the main stream have travelled around to a position where they are released off the drums'surface. The release of these seeds can be done in a variety of ways including deflection mechanisms on the outer side or by temporarily cutting off the vacuum supply on the inner side of the drum.
On seperation these seeds will continue to travel off along the tangent set at the point of release which will be a trajectory different to the main stream of seeds which were not attached.

Hence Section B has provided a mechanism for selecting seeds at regular intervals and seperating those selected seeds from the main seed stream thereby accurately metering those seperated seeds allowing for the counting and accurate spacing of those seeds.

The selected seperated seeds continue on to Section C whilst the unseperated seeds in the main stream continue on to Section F.

NOTE:

As the seed stream which has been accelerated by Section A is several seed widths thick it presents two surfaces. The diagrams provided show one side of this seed stream making contact with one drum surface in Section B. It should be noted that an additional drum placed directly opposite the first and rotating so that it selects seeds from the other side of the stream can be utilized. This means the accelerated seed stream passes between both drums. Further more as the unattached seeds in the stream travel on to Section F additional drums may be added below in a vertical tiered format.
The use of multiple drum setups can drastically increase a machines ground travel speed and also the area covered in one pass.

SECTION B

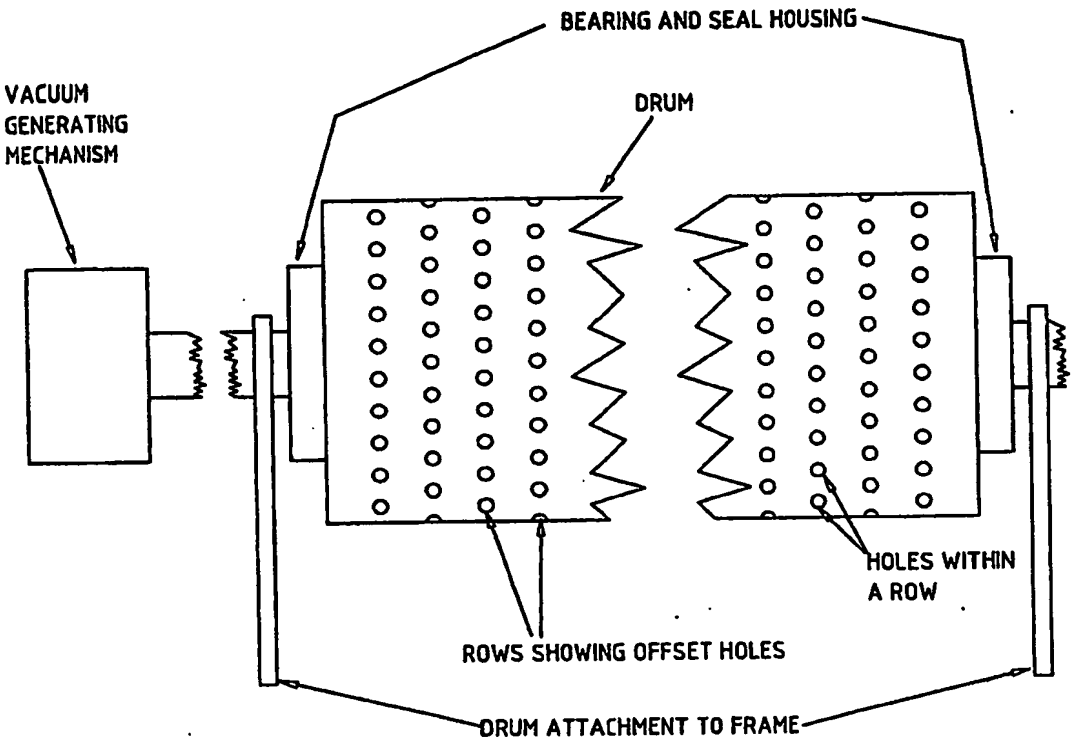


FIGURE 3

SIDE VIEW

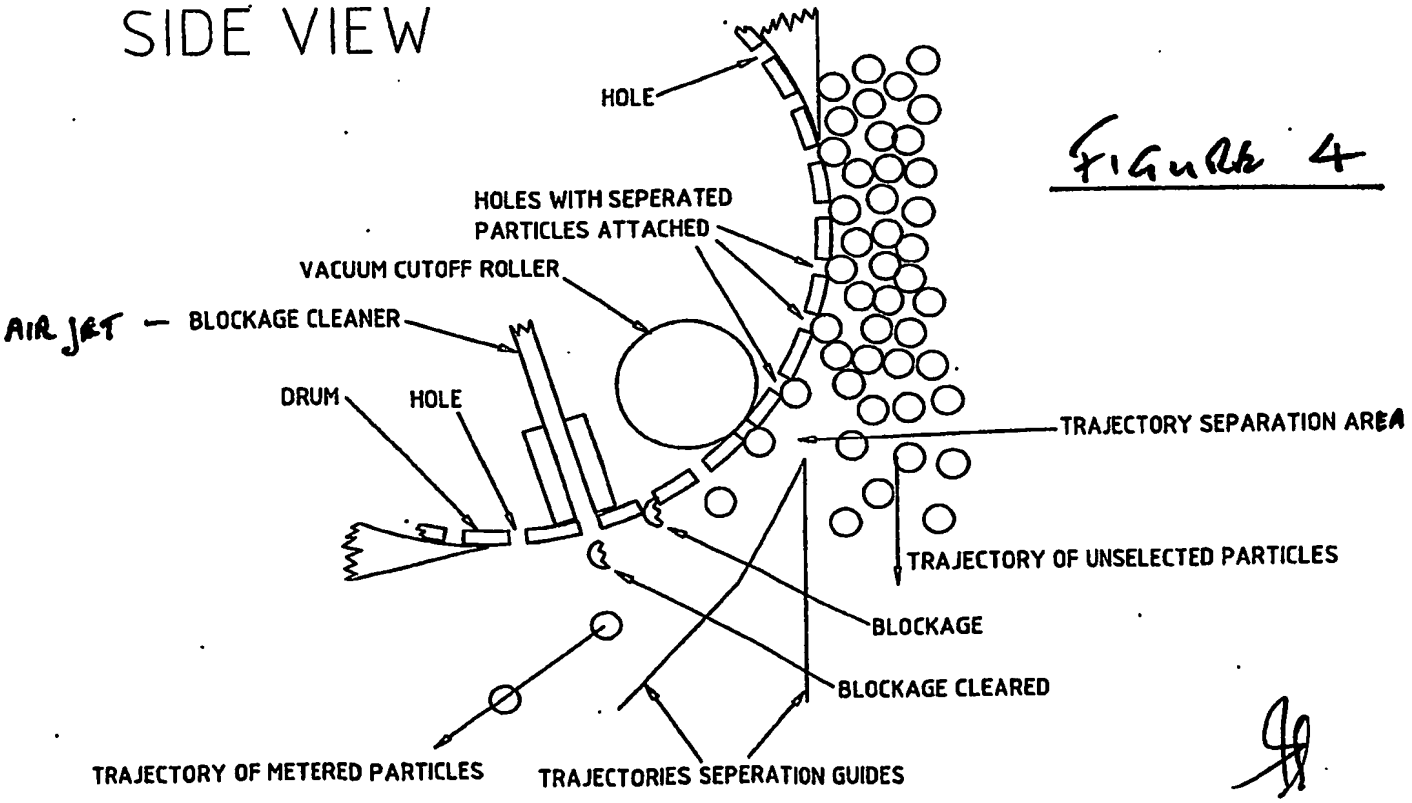


FIGURE 4

RAY SIDE VIEW OF SEED
ETERING MECHANISM
HOWING SECTIONS A,B,C,D AND F

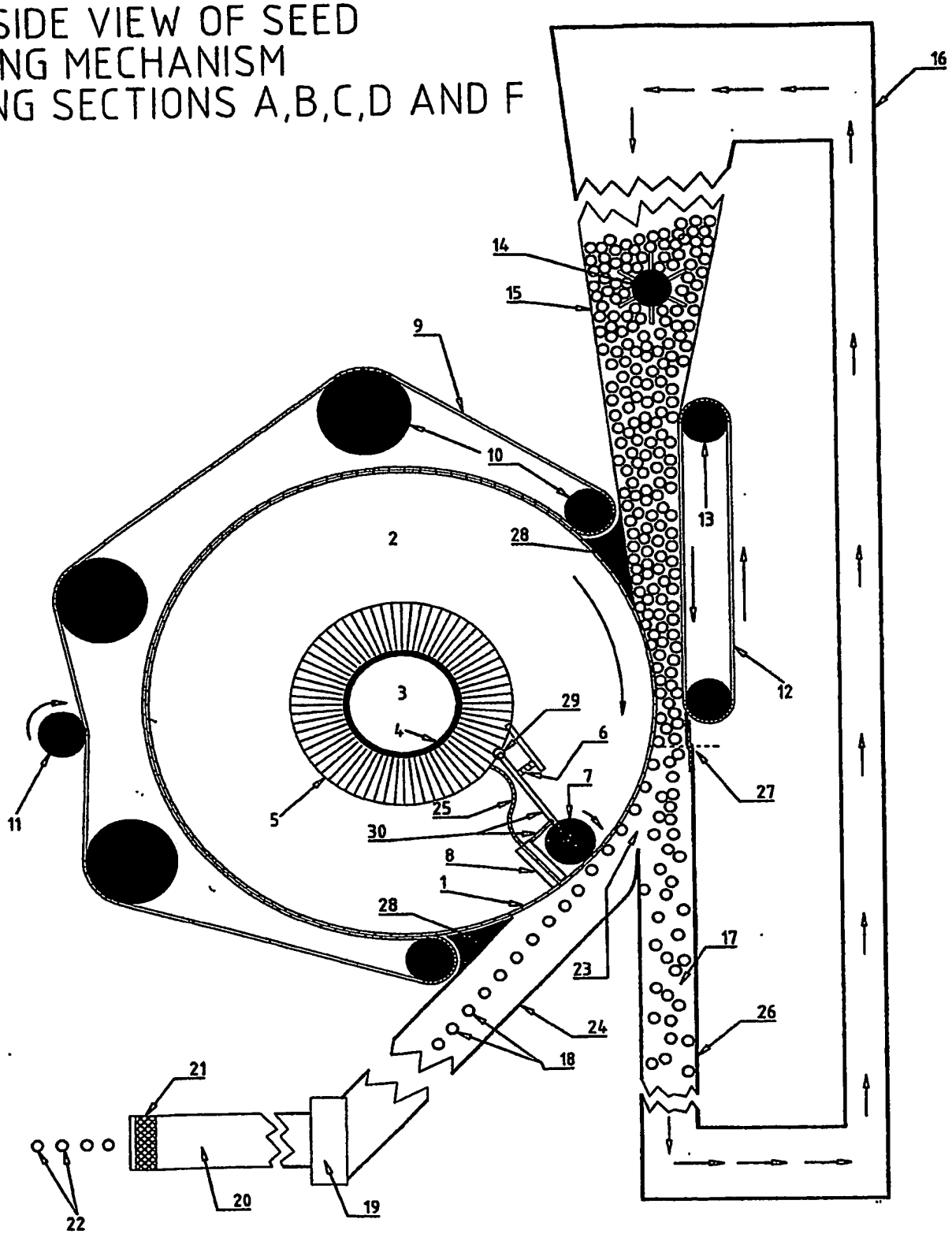


FIGURE 5

DETAILED IDENTIFICATION OF COMPONENTS SHOWN IN XRAY DIAGRAM

NOTE: In this document the word seed or seeds will be understood to mean any particulte material which can be used.

NOTE: This diagram is intended to illustrate the basic principals of the invention,is not drawn to scale and only shows one interpretation of many.

DETAILED DESCRIPTION OF THE NUMBERS:

1. Drum containing perforations and vacuum on inside - Section B
2. Area of low pressure - vacuum within drum
3. Hollow area in drum support axle by which vacuum is applied to drum
4. Hollow axle
5. Drum bearing & seal allowing drum rotation around stationery axle
6. Spring applying tension on vacuum cutoff roller to keep it on drum
7. Vacuum cutoff roller used to eject selected seeds off drum outer surface and also to set height of blockage clearing airjet. As the roller is in contact with the inner surface of the drum it is driven by the rotation of the drum.
8. Blockage clearance positive pressure air jet which may also be used to eject seeds as does 7. Where 8 meets the inner surface of the drum it has a seal designed to minimise the escape of the positive air pressure into 2 which is the vacuum area.
9. Flat belt which is kept on the outer surface of the drum by the suction pressure applied through the perforations and is therefore driven by the drums' rotation.This belt is used to block the drum perforations on a large part of the circumference thereby reducing the size and volume of the vacuum generating mechanism required.
10. Idler rollers supporting and guiding continuous flat belt 9
11. Tension roller used to keep tension on belt 9
12. Accelerator belt used to accelerate seeds - Section A
13. Accelerator belt drive pulley - can be independantly driven or driven mechanically off drum 1
14. Agitator - rotating, vibrating or both used to prevent blockages and ensure smooth flow of seeds - Section A
15. Receival hopper - Section A
16. Unseperated seeds recycle mechanism - Section F
17. Unseperated seeds in main stream - trajectory 1
18. Metered / seperated seeds evenly spaced - trajectory 2
19. Section C - venturi for conveying seeds to exit point and controlling seed exit velocity. One venturi per row on drum.
20. Tube or vein by which seeds are conveyed from 19 to exit points. These can be rigid or flexible allowing for row spacings to be adjustable.
21. Seed exit velocity monitor.
22. Evenly spaced seeds leaving rear of machine
23. Tracectories 1 & 2 seperation area
24. Corridor carrying metered seeds to Section C
25. Hose / vein supplying positive airjet pressure to 8
26. Corridor carrying unseperated main seed stream to Section F
27. Butterfly shut off valve used to stop seed flow
28. Wedge used as bock unused perforations on drum - same function as 9.
29. Hinge allowing 30 to swing away.
30. Support for 7 & 8 which are joined in such a way that the roller 7 sets the height of 8 and both act as seed ejection devices with 8 also clearing blocked perforations. The assembly is hinged 29 so that it can swing away from the drum inner surface if necessary and is held in place by the pulling pressure exerted by the spring 6

NOTE: The use of 9 & 28 assist in concentrating and maximising the suction effect produced by the vacuum inside the drum onto the seed seperation section and also results in not having to use as large a fan or vacuum pump for a given drum size.

RAY SIDE VIEW OF SEED
ETERING MECHANISM
HOWING SECTIONS A,B,C,D AND F

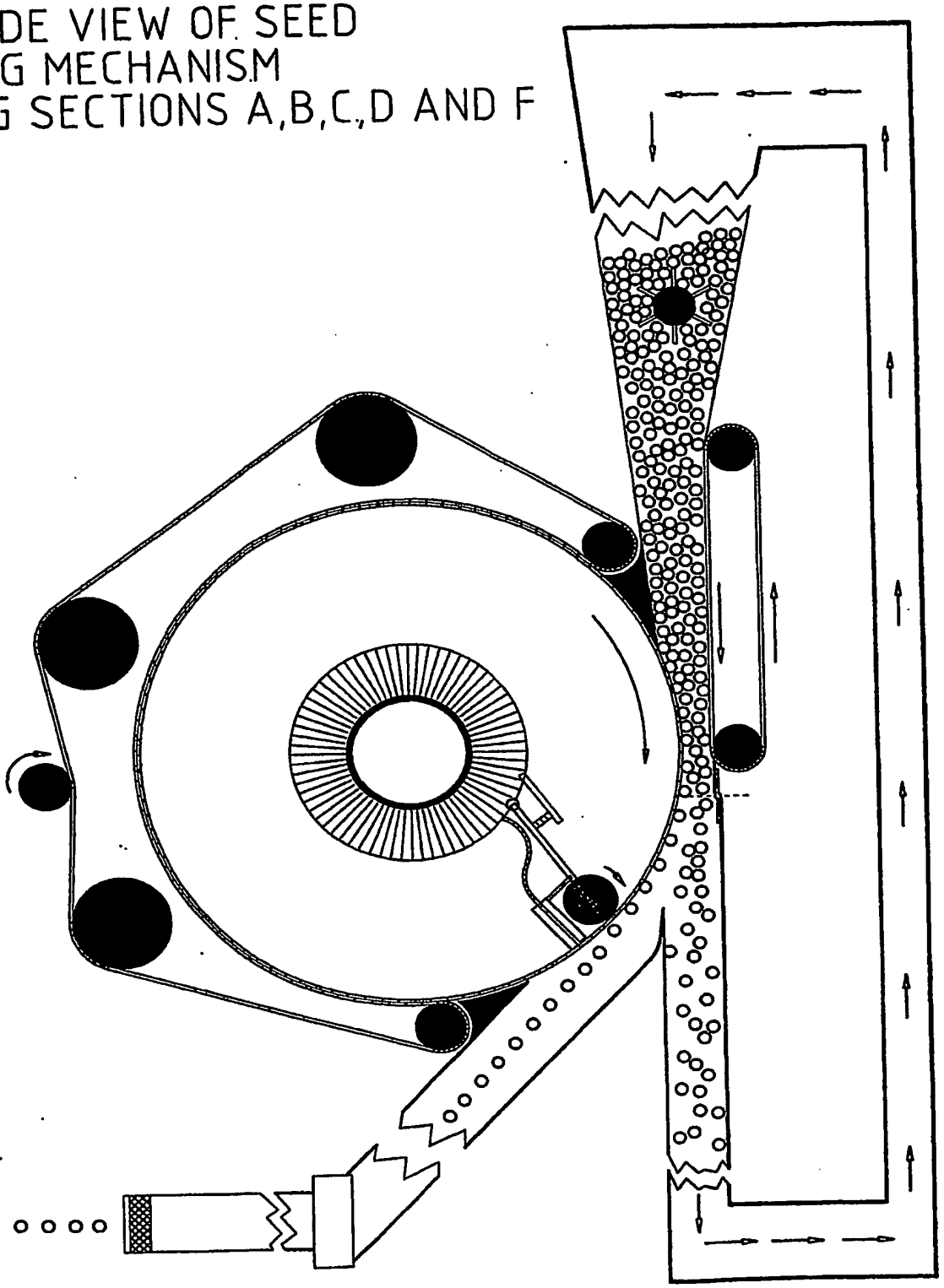


FIGURE 6

SECTION C

CONVEYING METERED PARTICLES AND CONTROLING PARTICLE EXIT VELOCITY

NOTE: In this document the word **seed** or **seeds** will be understood to mean any particulte material which can be used.

The function of Section C is to accept the metered seeds from Section B and convey them to the exit points on the machine.
This process may be accomplished in several ways including pneumatic or mechanical means.

One method is to have a system involving the guidance of the metered seeds originating from the rows of holes on the drum in Section B into the suction sides of multiple venturis with one venturi corresponding to one drum row. The venturi system will cause the seeds to travel along tubes or veins to their required exit points. If flexible tubes are used this will allow the distance between exit points to be variable allowing for the easy spacing of seeding row widths on the ground. Each row results from a particular tube which originates from a corresponding venturi which gets seeds from a particular row of holes on the drum in Section B and the spacing of each seed is set by the distance between the holes making up the rows on the drum and the rotational speed of the drum surface in relation to the ground speed of the machine.

By controlling the venturi system one is able to control the exit velocity of the seeds at the end of the tube. The advantage of controlling and by implication being able to vary the exit velocity of the seeds becomes clear at high machine travel speeds. A machine travelling in one direction at a ground speed of 50kph ejecting metered seeds horizontally from a height of 0.5 meters and in the opposite direction at 50kph will have the same effect as dropping seeds from a stationery position at 0.5 meters height resulting in minimal seed bounce and the maintainance of relatively even seed spacing.

SECTION D

PARTICLE EXIT VELOCITY AND TUBE BLOCKAGE MONITOR

NOTE: In this document the word **seed** or **seeds** will be understood to mean any particulte material which can be used.

The function of Section D is to moniter the velocity of seeds exiting the tubes originating from Section C.
This data is transferred to the electronic control Section E where it can be used to alert the system to a blockage resulting in a failure to seed on a particular row as well as enabling the setting of exit velocities to match machine ground speeds.

SECTION E

ELECTRONIC CONTROL UNIT

NOTE: In this document the word **seed** or **seeds** will be understood to mean any particulte material which can be used.

The function of Section E is to monitor and control the various operations on the machine including items such as seed exit velocity, machine ground speed, drum surface speed, drum rpm, seed count, area covered, seed rate/ha ,hopper seed levels,venturi output etc.

NOTE:

Whilst many functions on this seeding assembly do not in themselves constitute a new innovation the application of some could be taken as innovative. For example the use of an electronic device to record the exit speed of seeds (Section D) uses technology already available. However as seed velocity monitoring has not as yet been used on seeding machines which to date do not travel at high ground speeds, the advantages of monitoring seed exit velocities enabling these velocities to be controlled and varied on machines which do sow at higher ground speeds becomes apparent.An example has been described in the last paragraph in Section C.

SECTION F

MAIN STREAM (UNMETERED) PARTICLES RECYCLE / RETURN SYSTEM

NOTE: In this document the word **seed** or **seeds** will be understood to mean any particulte material which can be used.

This function of Section F is to collect all the seeds coming from Section B which were not seperated off by Section B and return them to the main storage bin or to the receival hopper in Section A.

NOTE:

1. If Sections A & B of the assembly are situated above the main seed storage bin the seeds will lifted into the receival hopper of Section A from the main storage bin and the seeds from Section F fall back into the main storage bin under gravity.

2. If Sections A & B of the assembly are situated below the main seed storage bin then the receival hopper in Section A can be supplied by gravitational means and the seeds from Section F can be returned to the main storage bin by pneumatic or mechanical means.

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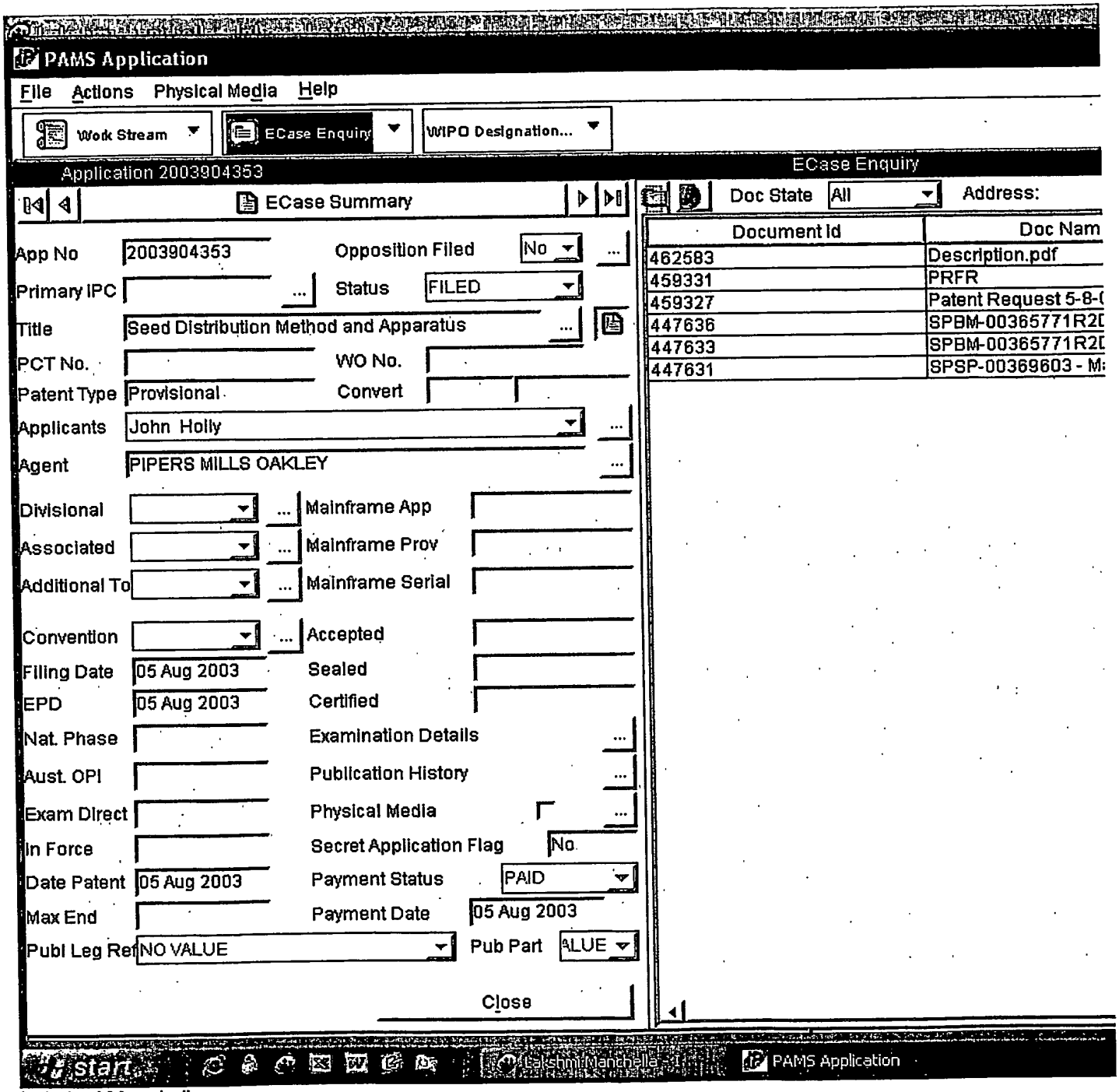

Lakshmi Manchella
Customer Operations Group
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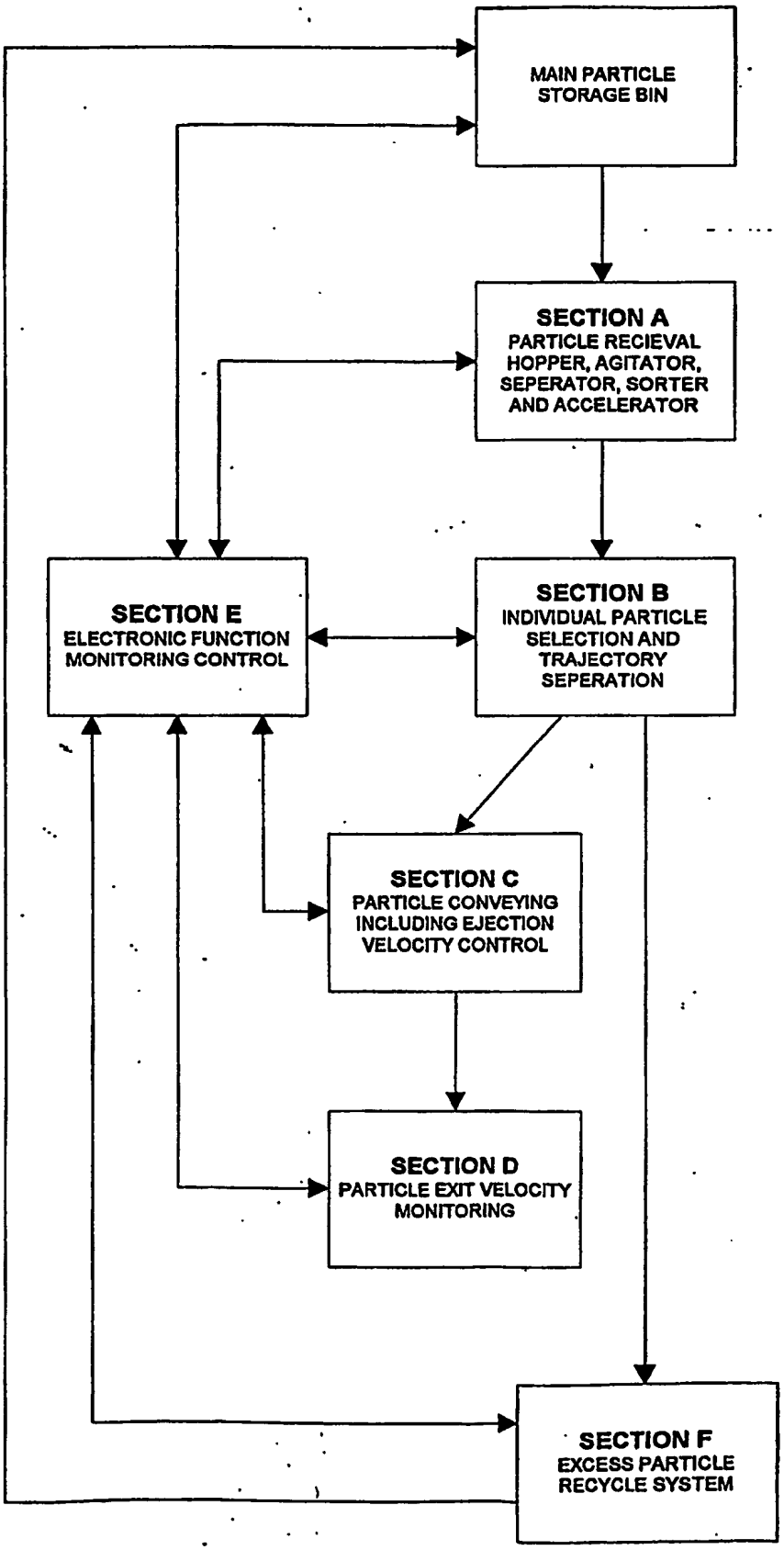
SCHEMATIC BLOCK DIAGRAM SHOWING SEPERATE FUNCTIONS ON MACHINE

DIAGRAM A



SECTION A

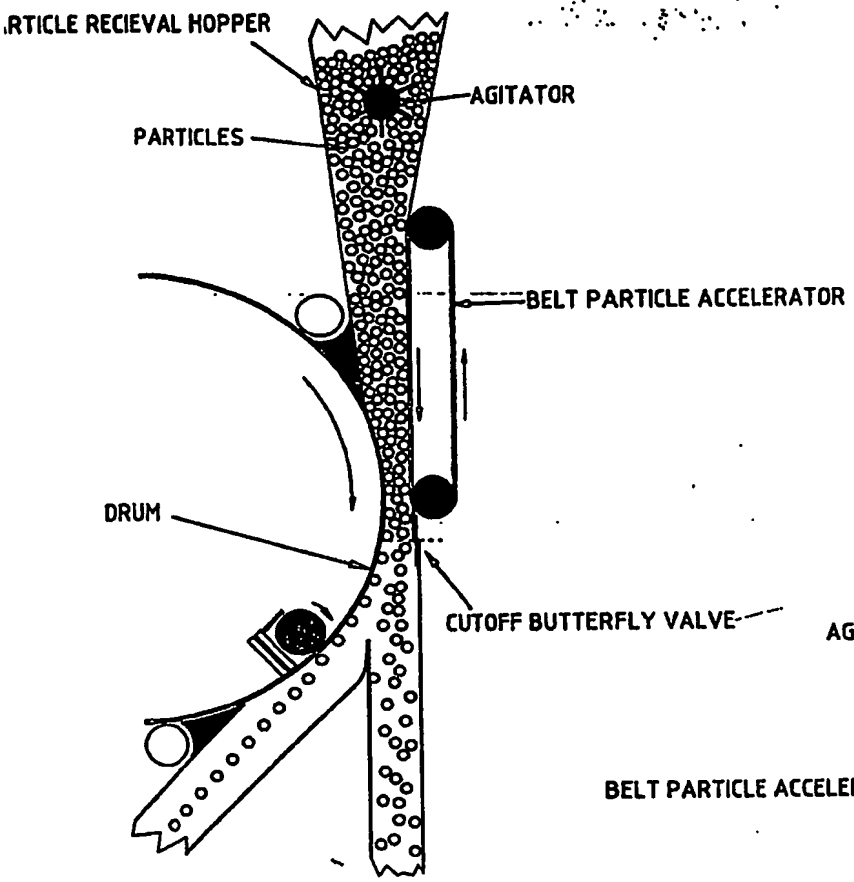


FIGURE 1.

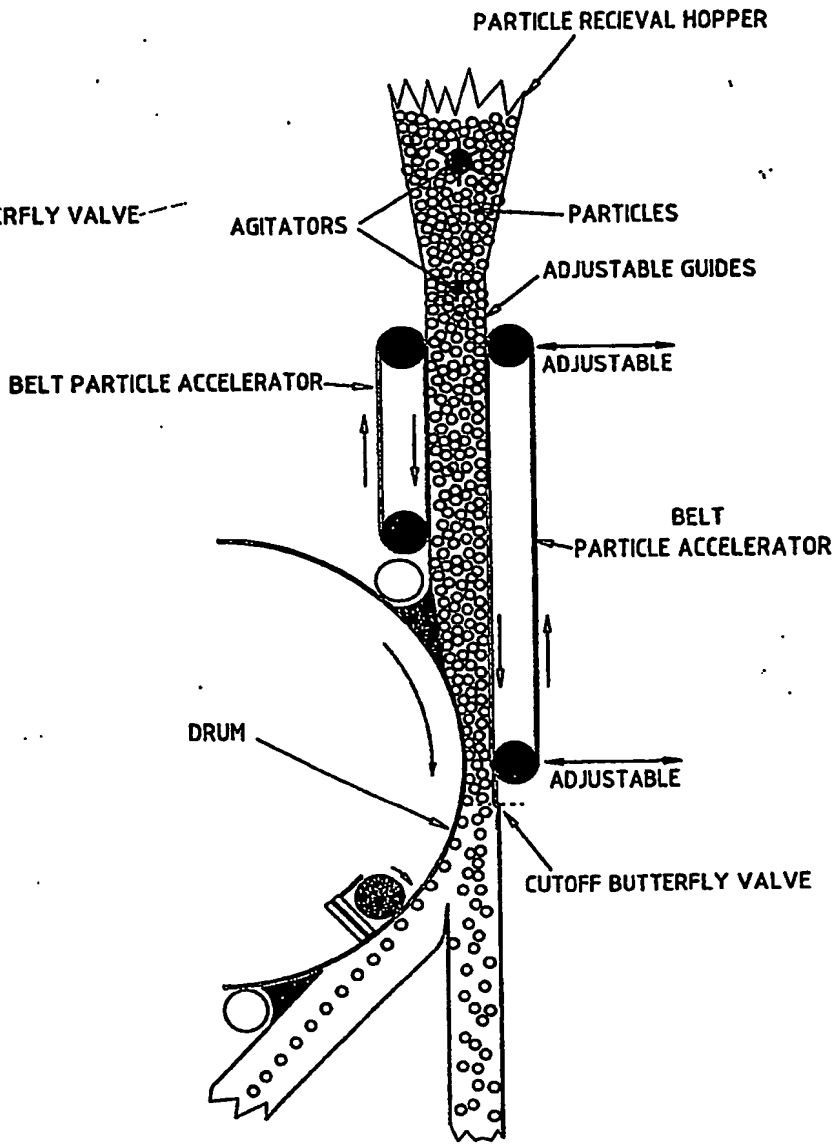


FIGURE 2.

SECTION B

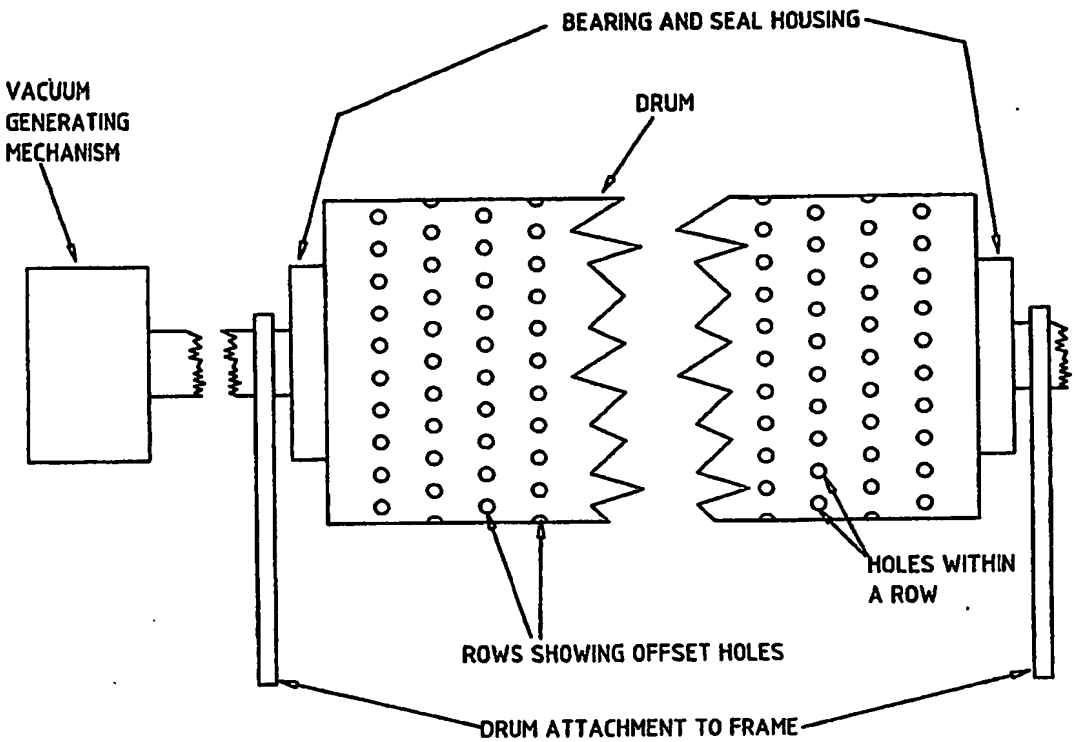


FIGURE 3

SIDE VIEW

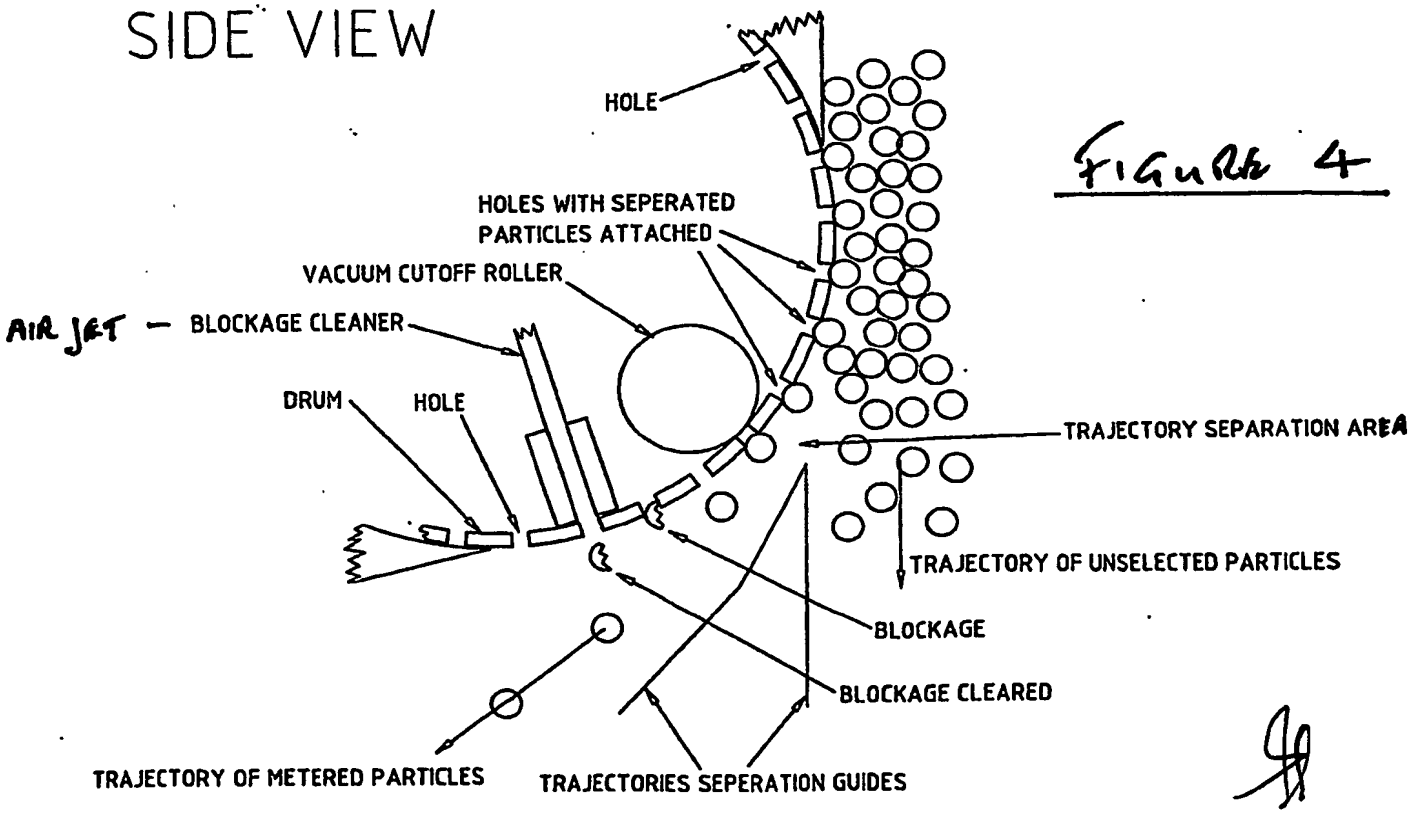


FIGURE 4

RAY SIDE VIEW OF SEED
ETERING MECHANISM
HOWING SECTIONS A,B,C,D AND F

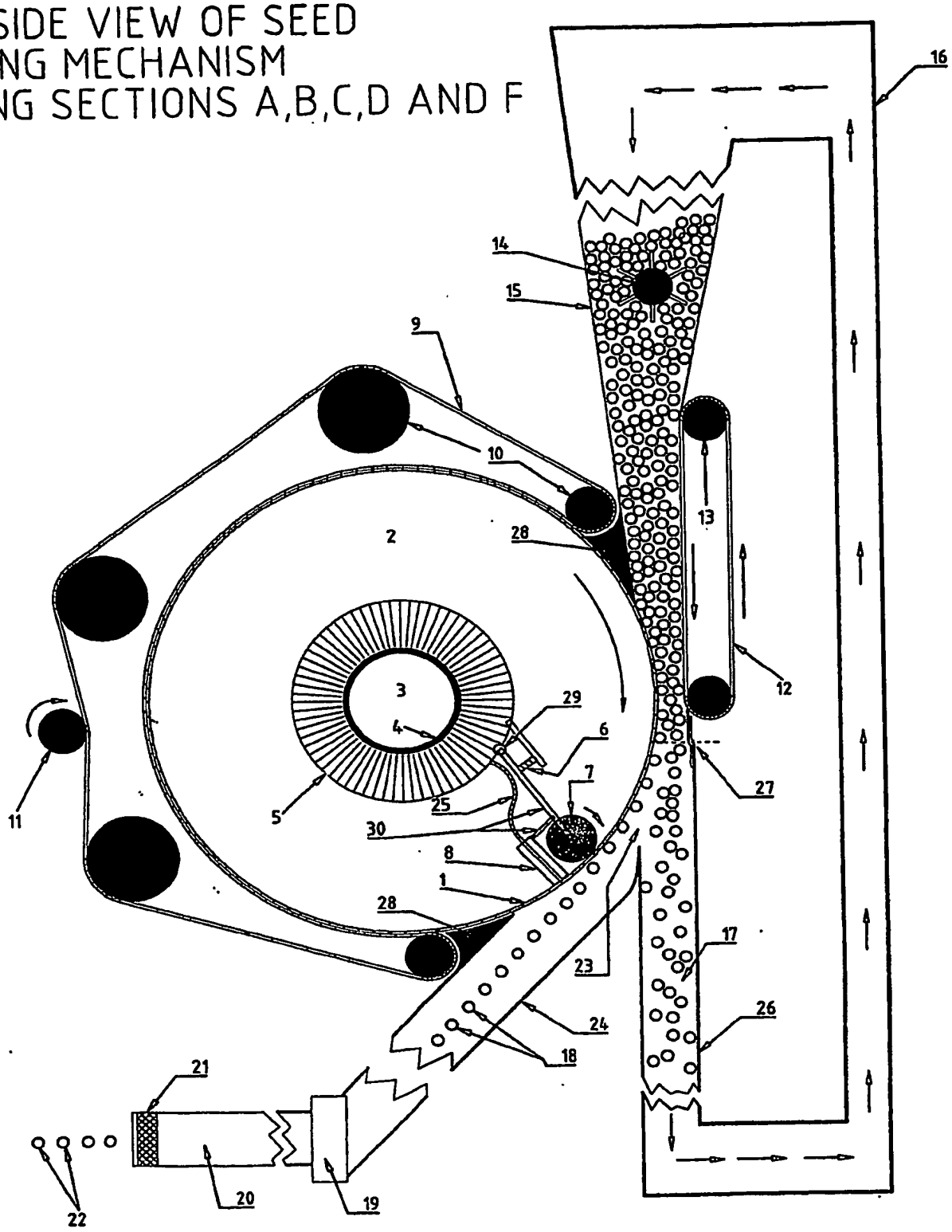


FIGURE 5

XRAY SIDE VIEW OF SEED METERING MECHANISM SHOWING SECTIONS A,B,C,D AND F

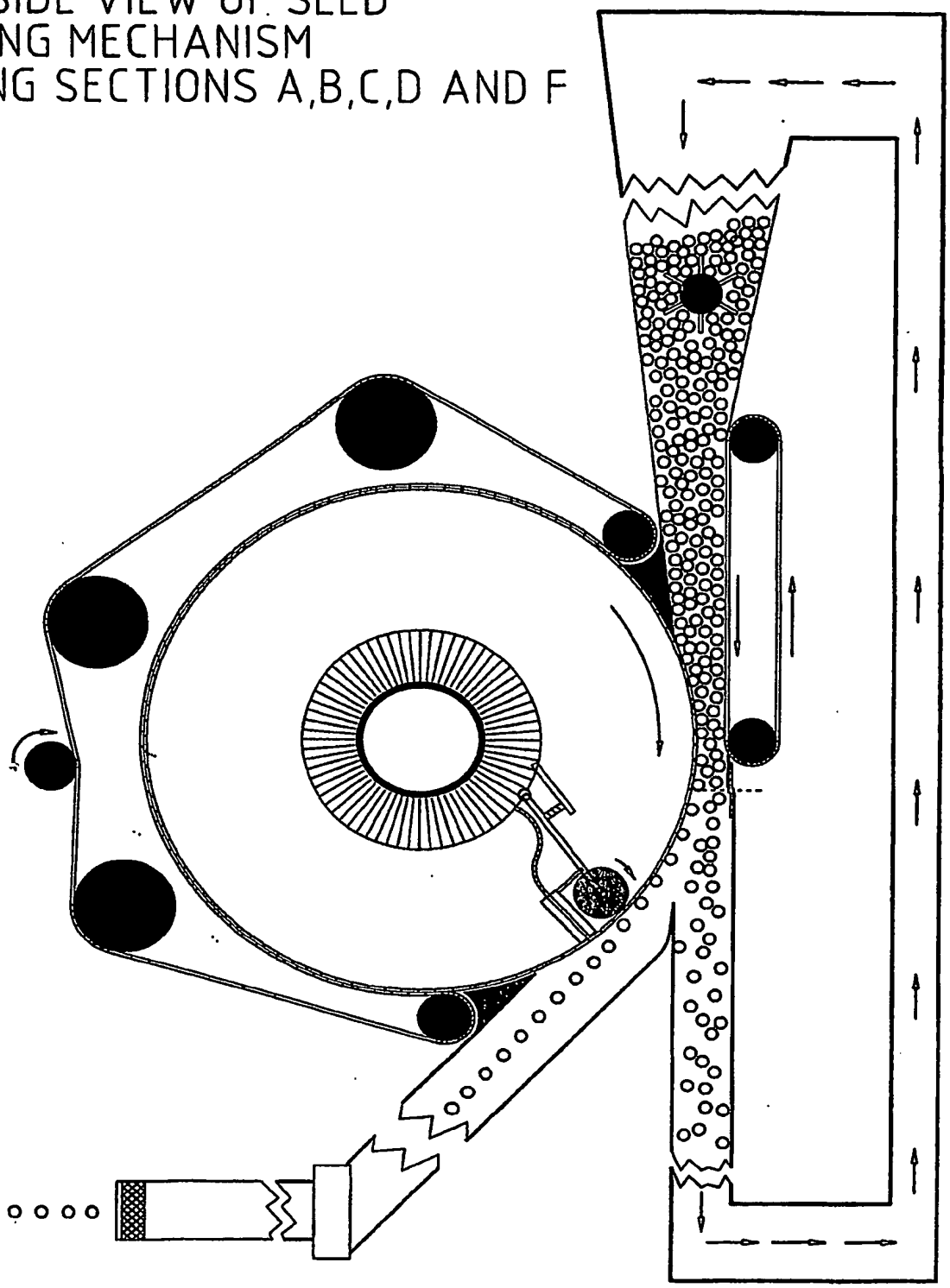


FIGURE 6